Proposed Enhancements to the IEEE 1451.2 Standard for Smart Transducers

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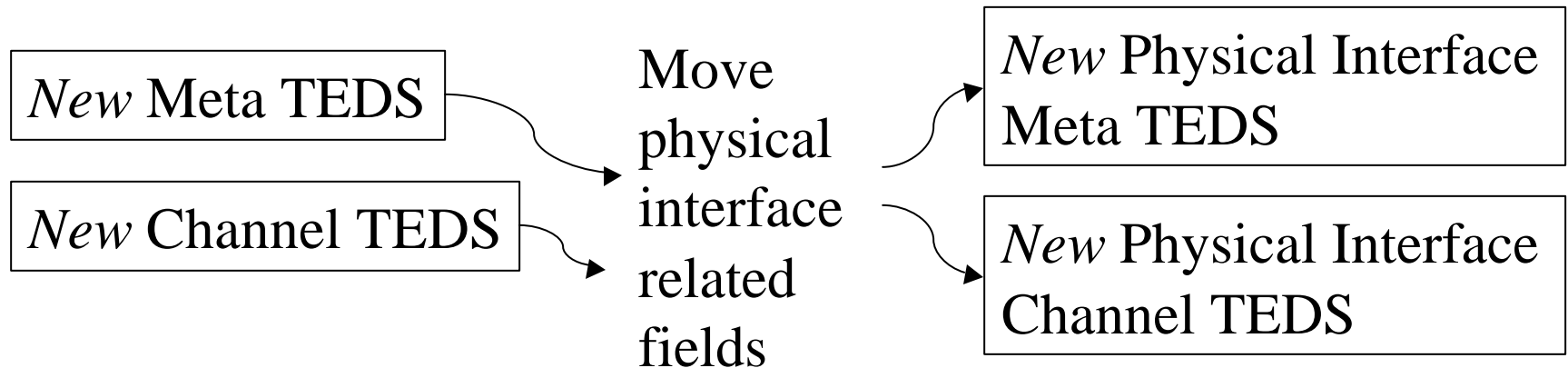
October 4, 2001

Most requested changes to IEEE 1451.2

- Make it easier to understand and implement
- Make the hardware interface faster
- Use less wires
- Pick a standard connector
- Provide for electrical isolation
- Allow real-time reconfiguration
- Add frequency response to TEDS and correction engine
- Make NCAPs readily available and compatible with existing systems
- Don't add unnecessary expense to simple transducers
- Add security, timestamps, data logging, etc.

Proposed enhancements to IEEE 1451.2

- Primary enhancements:
  - Partition the TEDS
  - Alternative physical layers
  - Partition the standard
- Secondary enhancements:
  - Enhance the TEDS
  - Add functions
  - Standalone function
  - Corrections and additions

Partition the TEDS

New Meta TEDS

New Channel TEDS

Move physical interface related fields

New Physical Interface Meta TEDS

New Physical Interface Channel TEDS

Meta-ID TEDS

Channel-ID TEDS

Other TEDS blocks can remain the same.

Supports use of different physical layers.

Proposed new IEEE 1451.2 TEDS blocks

Machine readable

Meta-TEDS
(mandatory)

Channel TEDS
(mandatory)

Calibration TEDS

Physical layer Meta-TEDS

Physical layer Channel-TEDS

Human readable

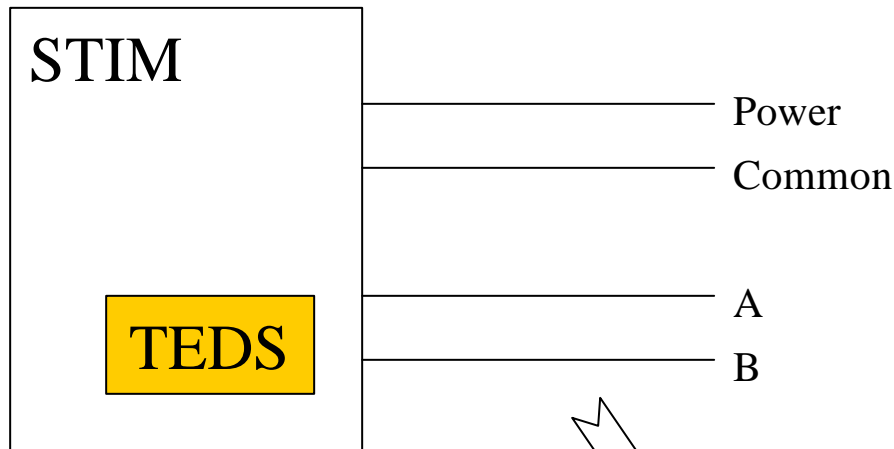**Meta-ID TEDS**

Channel ID TEDS

Calibration ID TEDS

Application specific

End Users' Application specific TEDS

Future extensions
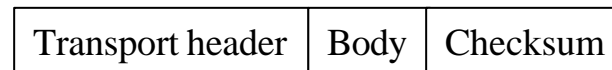
Industry Extension TEDS

Alternate physical layers

STIM

TEDS

Power

Common

A

B

Command/response

Transport header	Body	Checksum

Device addressing, message sequence numbers

Same command/response messages formats in the standard today

Triggering, trigger acknowledge, hot swap, and error reporting are embedded in messages exchanged via off-the-shelf asynchronous communication channel.
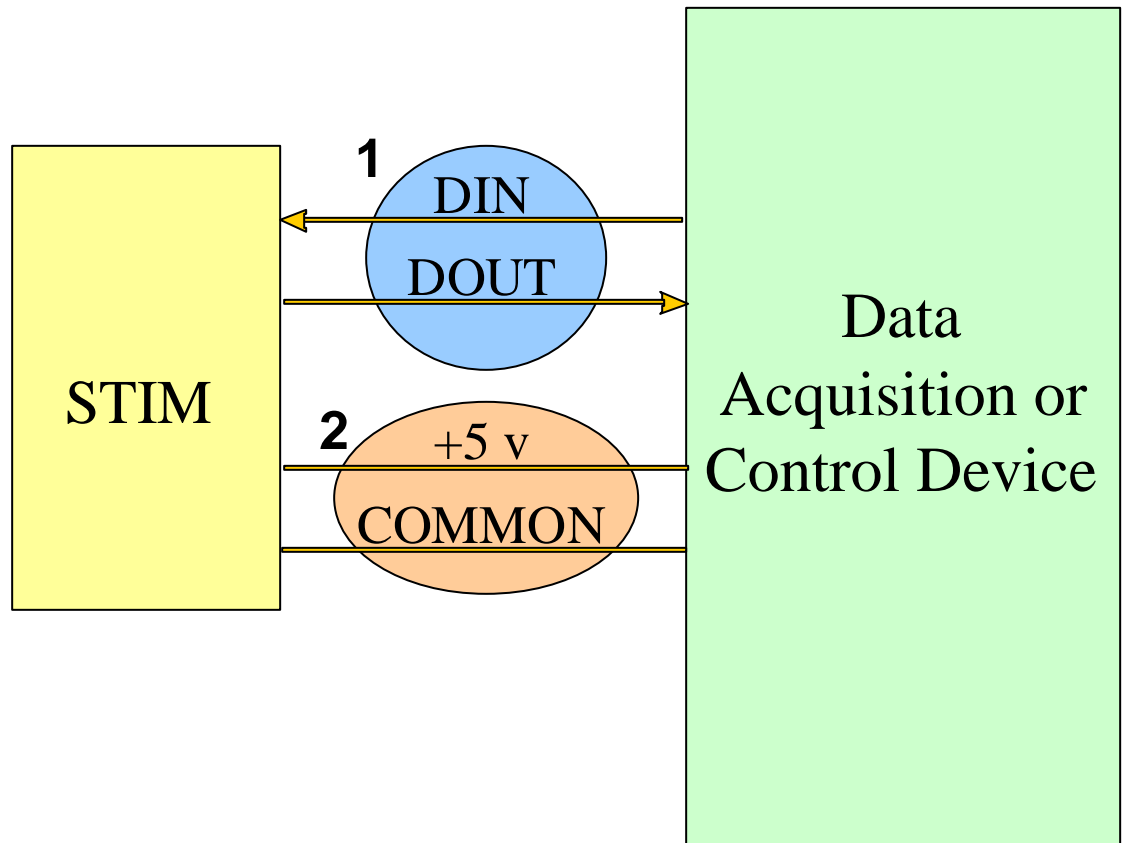
For example:
RS-232
RS-485
USB (?)

Proposed IEEE 1451.2 serial interface

1) Communication, triggering, error reporting
2) Power

Signal names for 1) will depend on particular physical layer

STIM

1 DIN
DOUT

2 +5 v
COMMON

Data Acquisition or Control Device

Support for serial IEEE 1451.2

Trends in UART support:

• present on most microprocessors

• chips have become smaller, less expensive, more robust

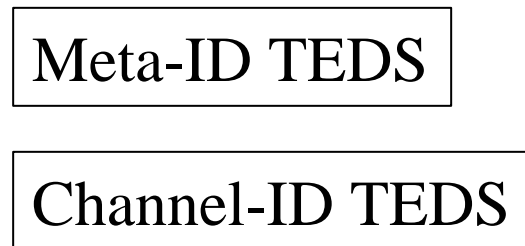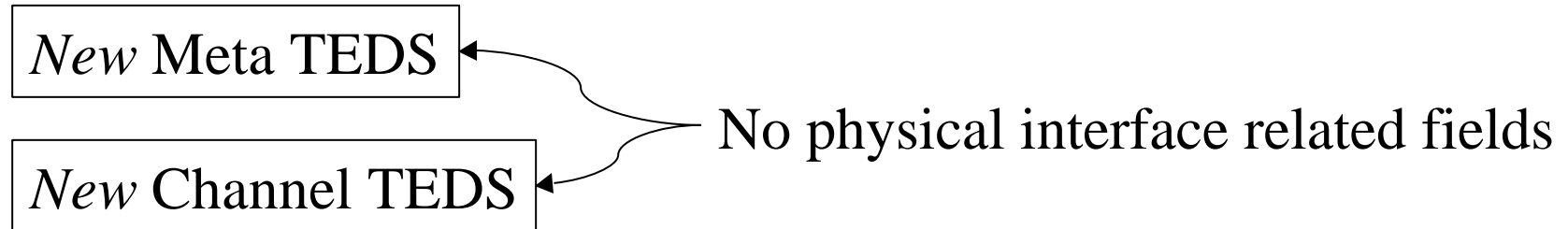• multi-port UARTs

• supported in ADI Microconverter family

Where can we plug into serial ports?

• Instruments

• I/O cards

• Computers

• VME, VXI, CPCI, PXI card cages

• Handhelds, PDAs

Partition the Standard

- Organize the standard around the OSI information model
- Separate sections for major functions:
  - TEDS
  - Correction engine
  - Physical layer

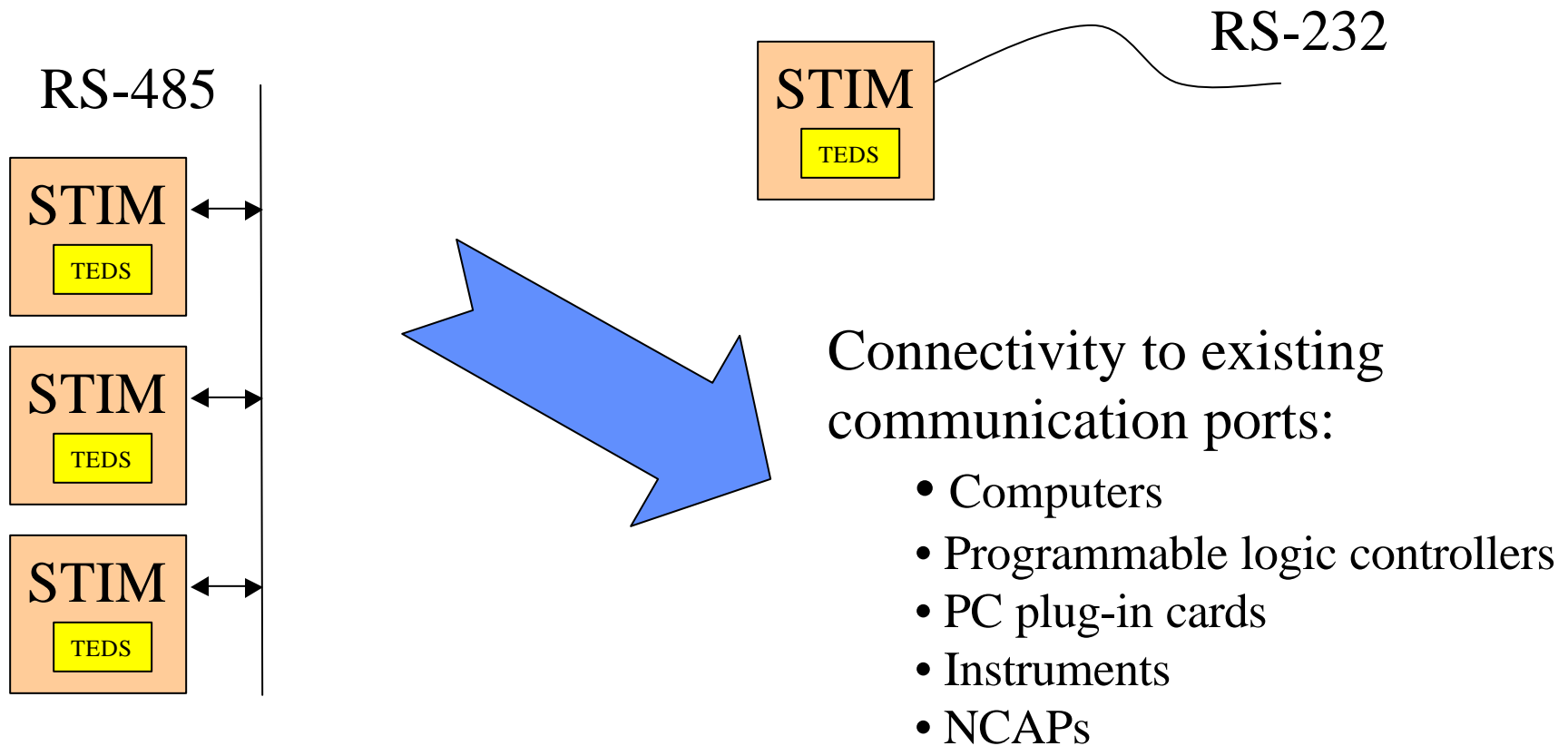# *Partition the standard (allow TEDS only)*

New Meta TEDS

New Channel TEDS

No physical interface related fields

Meta-ID TEDS

Channel-ID TEDS

⋮

Other TEDS blocks can remain the same.

Secondary enhancements

- Enhance the TEDS
  - Add features from IEEE P1451.3 and IEEE P1451.4
    - Bandwidth
    - Frequency response
    - XML format
    - Etc.
- Add functions
  - Control function to tell NCAP to reload TEDS
  - Support STIM reconfiguration:
    - Gain, bandwidth, etc.
    - Changes in channels due to hot-swap in local sub-net, including IEEE P1451.3 or IEEE P1451.4
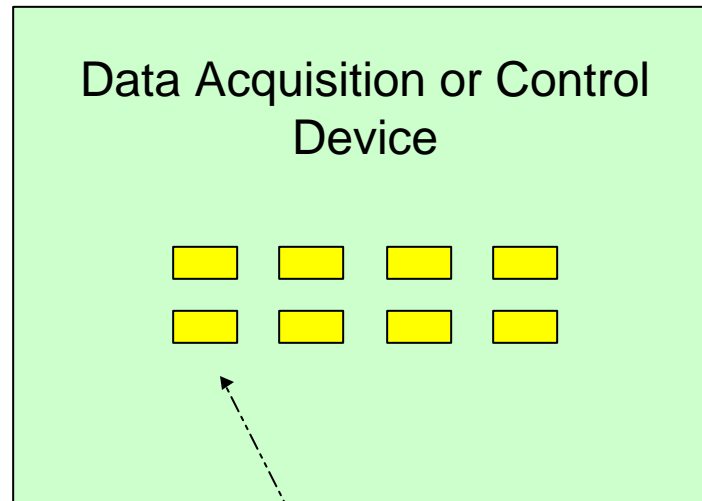
Secondary enhancements, con't.

- Standalone function
    - Support use with existing data and control systems
    - Map IEEE 1451.2 functions to existing protocols:
        - Modbus RTU
        - Modbus/TCP
        - ProfiBus
        - HTTP URL-based
        - XML
        - Etc.
- Corrections and additions
    - Miscellaneous comments received since publication
    - Others identified during review and updating process

New connectivity enabled by enhancements

RS-232

RS-485

STIM
TEDS

STIM
TEDS

STIM
TEDS

STIM
TEDS

Connectivity to existing communication ports:

- Computers
- Programmable logic controllers
- PC plug-in cards
- Instruments
- NCAPs

Applications for serial IEEE 1451.2

Multi-port serial device
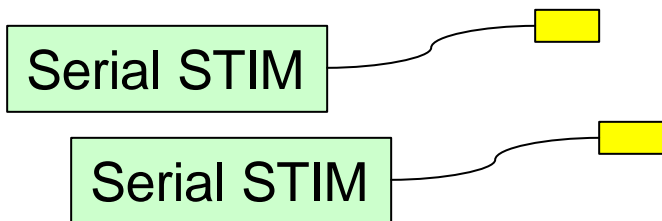
Data Acquisition or Control
Device

Multiple serial ports:

• Plug and play across all ports

• Standard serial ports

Serial STIM

Serial STIM

Industrial card cage I/O card

I/O cards

Controller

Serial STIM

Serial STIM
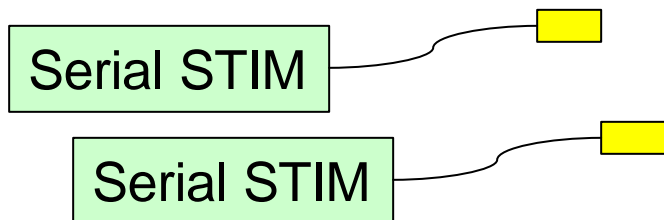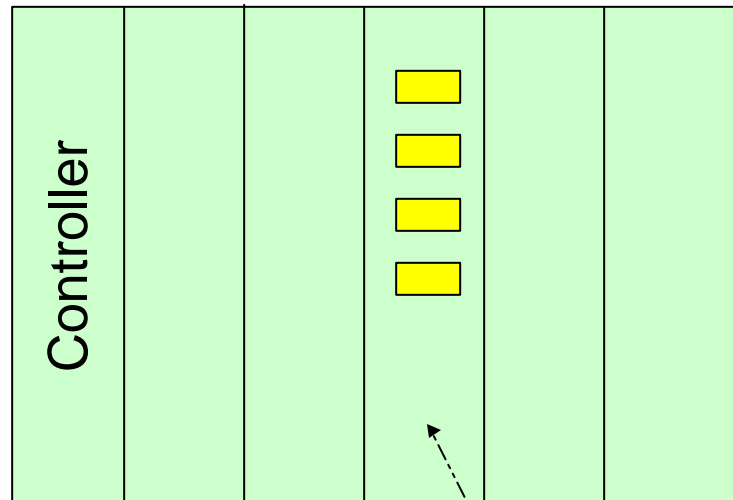
Multiple serial ports:

• Plug and play across all ports

• Standard serial ports

# *Computers and PDAs*
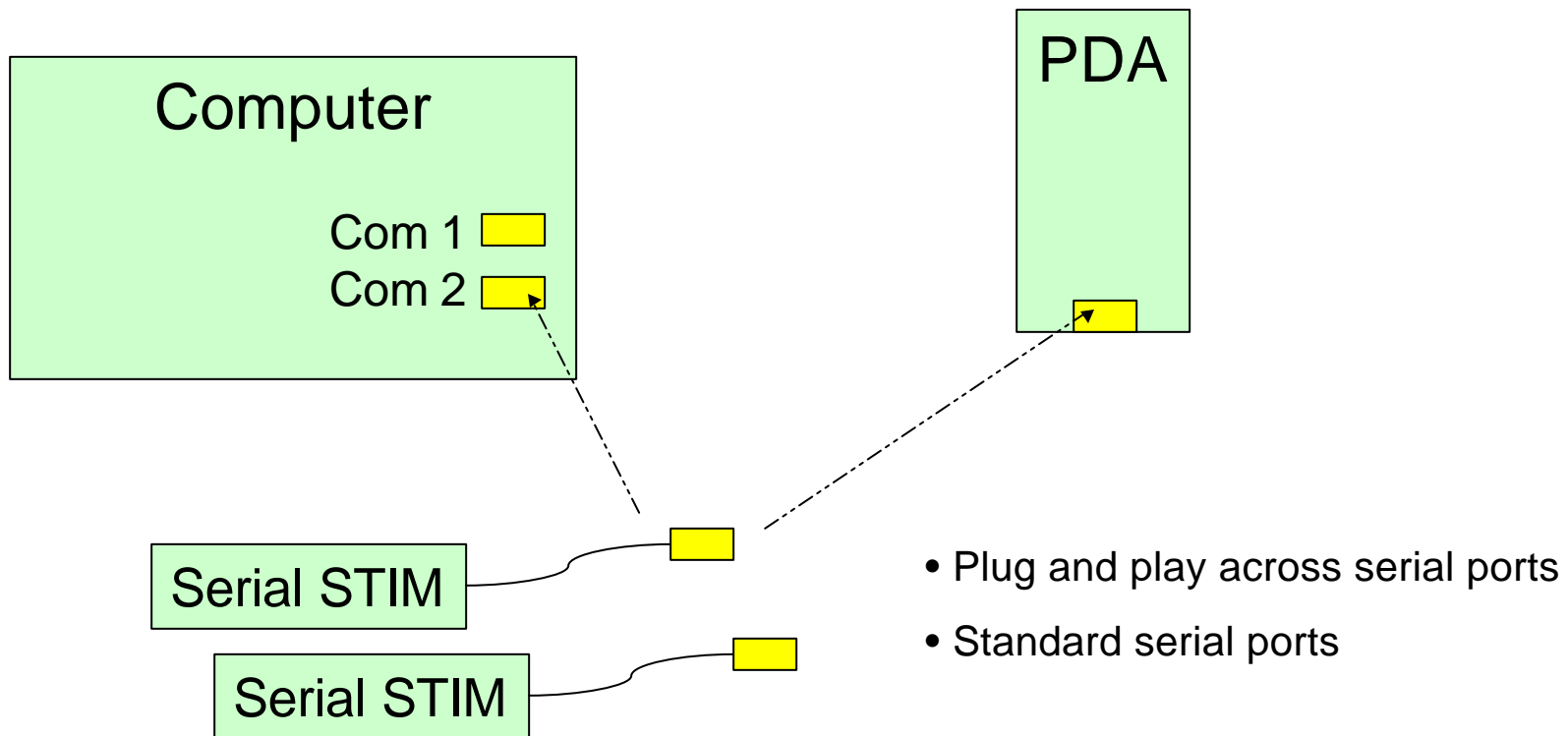
PDA

Computer

Com 1
Com 2

Serial STIM

Serial STIM

- Plug and play across serial ports

- Standard serial ports

Most requested changes to IEEE 1451.2

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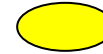
Addressed by going to serial interface
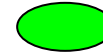
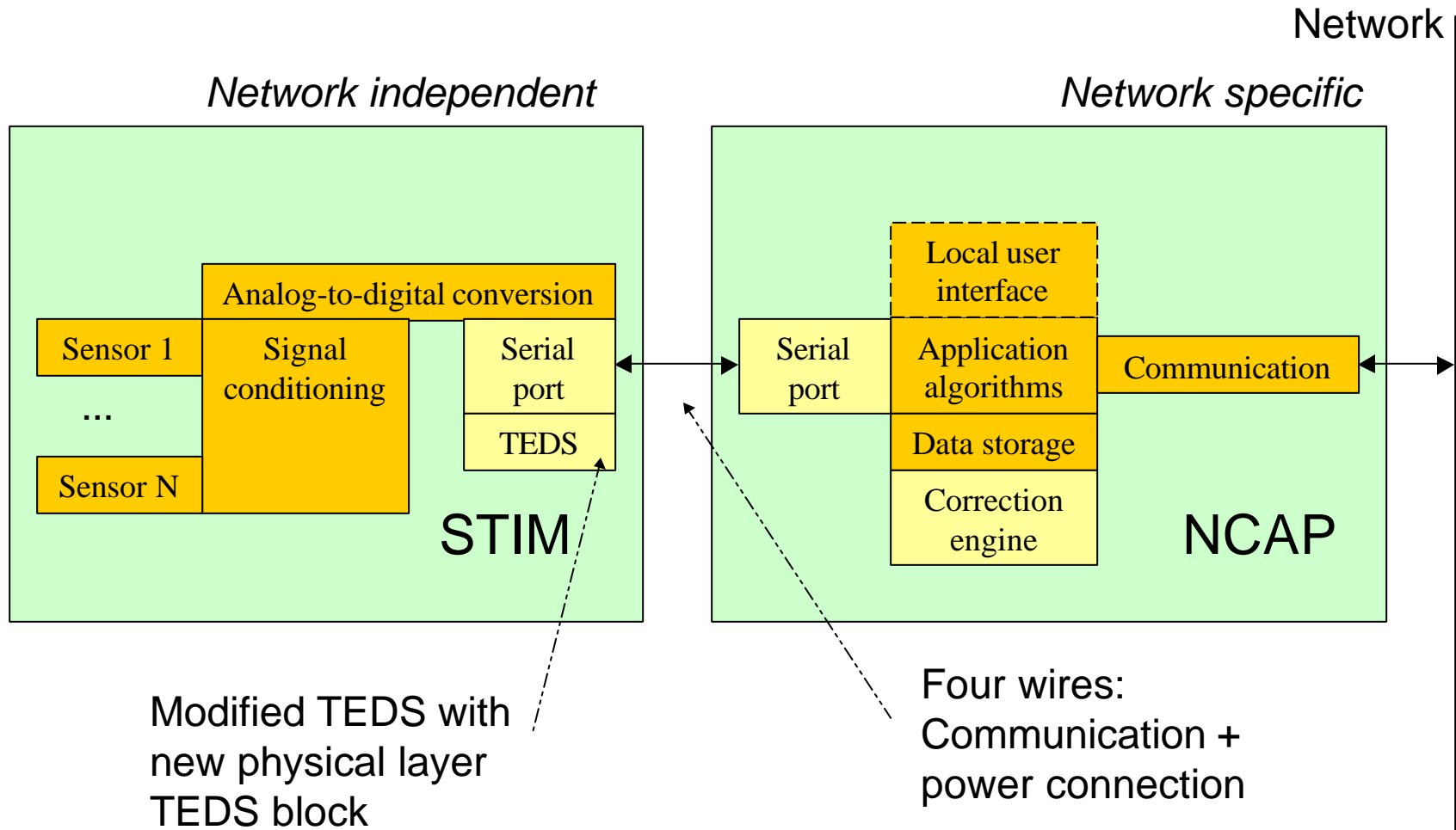Addressed by other proposed enhancements

Conclusions

- IEEE 1451.2 established several valuable basic principles of smart transducers

- The most important of these is the TEDS

- We need to keep the best parts of the original standard while addressing the current needs of the marketplace

- The proposed enhancements will address the major requested changes and will result in:
    - More flexibility
    - Lower cost
    - Improved connectivity

- We need user comments and feedback on the proposed enhancements

Questions/Comments?

Proposed serial version of IEEE 1451.2

Network

Network independent

Network specific

Analog-to-digital conversion

Sensor 1

Signal
conditioning

Serial
port

...

TEDS

Sensor N

STIM

Local user
interface

Serial
port

Application
algorithms

Communication

Data storage

Correction
engine

NCAP

Modified TEDS with
new physical layer
TEDS block

Four wires:
Communication +
power connection

Where to put the STIM interface electronics?